WHAT IS CLAIMED IS:

1. An UV flux multiplying air sterilization chamber comprising:

a plurality of inner surfaces, wherein at least one of said inner surfaces comprises a reflective material having a diffuse reflective behavior and a reflectivity of greater than about 75%;

an inlet aperture for air to flow into the chamber and an outlet aperture for air to flow out of said chamber; and

a light source emitting an UV light, wherein a flux of said UV light is multiplied by reflecting said UV light multiple times from the inner surfaces of the chamber.

2. The air sterilization chamber of claim 1, wherein said light source is positioned inside the chamber.

3. The air sterilization chamber of claim 1, wherein said reflective material has a UV light reflectivity of more than about 94%.

4. The air sterilization chamber of claim 1, wherein said apparatus is a parallelepiped shape.

5. The air sterilization chamber of claim 1, wherein said apparatus is generally cylindrical.

6. The air sterilization chamber of claim 1, wherein said reflective material comprises expanded PTFE.

7. The air sterilization chamber of claim 1, wherein said reflective material comprises a mixture of a binder and reflecting additives such as barium sulfate, magnesium fluoride, magnesium oxide or aluminum oxide, holmium oxide, calcium oxide, lanthanum oxide, germanium oxide, tellurium oxide, europium oxide, erbium oxide, neodymium oxide, samarium oxide or ytterbium oxide.

8. The air sterilization chamber of claim 1, wherein said reflective material comprises one of spectralon, ODM, and Alzak.

9. The air sterilization chamber of claim 1, wherein the light source is outside the chamber and transmits light into the chamber.

10. The air sterilization chamber of claim 1, wherein the light source is outside the chamber and transmits light through a quartz window into the chamber.

11. The air sterilization chamber of claim 1, wherein the inlet and outlet aperture each comprise light reflecting fibers and a frame for housing said light reflecting fibers, wherein air flows through said inlet and outlet apertures.

12. The air sterilization chamber of Claim 11, wherein said light reflecting fibers are arranged as a non-woven fabric.

13. The air sterilization chamber of Claim 11, wherein said light reflecting fibers are highly reflective of UV light.

14. The air sterilization chamber of Claim 12, wherein said non-woven fibers comprise quartz fibers with diameters between about 1 and 15 microns and lengths from about 1 micron to 20 centimeters.

15. The air sterilization chamber of Claim 12, wherein said non-woven fibers comprise at least one of quartz, glass, PTFE, polystyrene, Teflon, latex, and cotton.

16. The air sterilization chamber of Claim 11, wherein said light reflecting fibers are coated with réflecting material.

17. The air sterilization chamber of Claim 12, wherein said non-woven fabric is reinforced with strengthening members.

18. The air sterilization chamber of Claim 17, wherein said strengthening members comprise at least one of wire and rods.

19. The air sterilization chamber of Claim 12, wherein said non-woven fabric is pleated to provide additional strength.

20. The air sterilization chamber of Claim 1, wherein a pressure drop within the apparatus is less than about 0.3 w.i.g.

21. The air sterilization chamber of Claim 11, wherein said light reflecting fibers comprise an outside woven fabric containing small highly reflective particles.

22. The air sterilization chamber of Claim 21, wherein said light reflecting fibers further comprise an inside woven fabric containing small highly reflective particles.

23. The air sterilization chamber of Claim 11, wherein said small highly reflective particles are highly reflective for UV light.

24. The air sterilization chamber of Claim 21, wherein said woven fabric is about 90% reflective to light.

25. The air sterilization chamber of Claim 11, wherein said small highly reflective particles comprise nanocrystals of a material with a diameter from 100 nm to 3 microns.

26. The air sterilization chamber of Claim 25, wherein said material comprises one of Al2O3 and TiO2.

27. The air sterilization chamber of Claim 21, wherein said highly reflective particles are from about 3 microns to 60 microns in diameter.

28. The air sterilization chamber of Claim 21, wherein said highly reflective particles are less than or equal to about 1 inch in length.

29. The air sterilization chamber of Claim 21, wherein said highly reflective particles are coated with chemicals such as reflecting paints or metals to enhance their reflectivity.

30. The air sterilization chamber of Claim 21, wherein a pressure drop within the apparatus is less than about 0.3 w.i.g.

31. The air sterilization chamber of Claim 1, wherein the ratio of an area of said one or more apertures plus a light absorbing surface area of said light source are less than about 5% of a total inner surface area of the sterilization chamber.

32. The air sterilization chamber of Claim 1, further comprising blocking means for limiting escape of light through said inlet aperture and said outlet aperture.

33. The air sterilization chamber of Claim 32, wherein the blocking means consists of structures with open and closed spaces.

34. The air sterilization chamber of Claim 32, wherein the blocking means comprises more than one surface.

35. The air sterilization chamber of Claim 32, wherein the blocking means comprises slats that are separated by open spaces.

36. The air sterilization chamber of Claim 35, wherein a surface of the slats facing the inside of the chamber comprise diffuse reflecting material with a reflectivity of greater than 75%.

37. The air sterilization chamber of Claim 1, wherein the air flow through said inlet and outlet apertures is modified by insertion of chevrons into an air flow stream in order to decelerate the air flowing through said inlet and outlet apertures.

38. The air sterilization chamber of Claim 1, wherein air flowing through said inlet and outlet apertures is modified by aerodynamically shaping the contour of the opening.

39. A flux multiplying air sterilization chamber comprising:

a plurality of inner surfaces, wherein at least one of said inner surfaces comprises a reflective material having a diffuse reflective behavior;

an inlet aperture for air to flow into the chamber and an outlet aperture for air to flow out of said chamber, wherein the inlet and outlet aperture each comprise light reflecting fibers and a frame for housing said light reflecting fibers, wherein air flows through said inlet and outlet apertures; and

a light source emitting a light, wherein a flux of said light is multiplied by reflecting said light from the at least one of said inner surfaces and the light reflecting fibers.

40. A flux multiplying air sterilization chamber comprising:

a plurality of inner surfaces, wherein at least one of said inner surfaces comprises a reflective material having a diffuse reflective behavior;

an inlet aperture for air to flow into the chamber and an outlet aperture for air to flow out of said chamber, wherein at least one of the inlet and outlet aperture comprises an air spreader for decreasing the velocity of air passing through said at least one of the inlet and outlet aperture; and

a light source emitting a light, wherein a flux of said light is multiplied by reflecting said light from the at least one of said inner surfaces and the light reflecting fibers.

41. The flux multiplying air sterilization chamber of Claim 40, wherein said air spreader is triangular shaped.

42. The flux multiplying air sterilization chamber of Claim 40, wherein said air spreader is chevron shaped.

43. The flux multiplying air sterilization chamber of Claim 40, wherein said at least one of the inlet and outlet aperture comprises a plurality of air spreaders.

44. A flux multiplying air sterilization chamber comprising:

an inlet aperture for air to flow into the chamber and an outlet aperture for air to flow out of the chamber;

a light source disposed inside said chamber and configured to emit light within said chamber;

a moveable inlet device with at least one surface that is highly reflective and configured to increase the fraction of chamber interior surface area that is reflective within said sterilization chamber when said light is emitted; and

a moveable outlet device with at least one surface that is highly reflective and configured to increase the fraction of chamber interior surface area that is reflective within said sterilization chamber when said light is emitted.

45. The sterilization chamber of Claim 44, wherein at least one of said moveable inlet and outlet devices are configured to more fully cover said apertures when said light source is emitting light and to less fully cover said apertures when said light source is not emitting light.

46. The sterilization chamber of Claim 44, wherein said light source is a pulsed light source.

47. The sterilization chamber of Claim 44, wherein the moveable inlet and the moveable outlet devices simultaneously cover and uncover said apertures.

48. The sterilization chamber of Claim 44, wherein said moveable inlet and the moveable outlet devices comprise flaps that are pivotably coupled to said chamber.

49. The sterilization chamber of Claim 48, wherein at least one of said flaps slides parallel to an outer surface of said chamber to cover at least one of said apertures when said light source is emitting light and slides away from said apertures when said light source is not emitting light.

50. The sterilization chamber of Claim 48, wherein at least one of said flaps slides parallel to an outer surface of said chamber to cover at least one of said apertures when said pulsed light source is emitting light and slides away from said apertures when said pulsed light source is not emitting light.

51. The sterilization chamber of Claim 44, wherein at least one of said moveable inlet and outlet devices comprises multiple slats, wherein said at least one of said moveable inlet and outlet devices is closed when said light source is emitting light and is open when said light source is not emitting light.

52. The sterilization chamber of Claim 44, wherein at least one of said moveable inlet and outlet devices comprises a rotating drum having a plurality of retractable vanes extending from a peripheral surface of said rotating drum.

53. The sterilization chamber of claim 52, wherein said at least one rotating drum apparatus comprises:

a rotating drum mounted on an axle inside a housing coupled to said inlet aperture; and

a retractable vane having a reflective surface and coupled to an outer surface of said rotating drum and configured to extend from said outer surface of said drum when no external pressure is applied to said retractable vane.

54. The sterilization chamber of Claim 53, wherein said rotating drum is caused to rotate by the flowing air.

55. The sterilization chamber of Claim 53, wherein said rotating drums is caused to rotate by a motor.

56. The sterilization chamber of Claim 44, wherein a surface of said moveable inlet device and a surface of said moveable outlet device that face the light source have a reflectivity of greater than 75%.

57. The sterilization chamber of Claim 44, wherein a surface of said moveable inlet device and a surface of said moveable outlet device that face the light source have a reflectivity substantially the same as the inner surfaces of said chamber.

58. The sterilization chamber of Claim 44, wherein said light source has a small light absorbing area.

59. The sterilization chamber of Claim 44, wherein said light source emits a fluence of light greater than 10 joules per square inch.

60. The sterilization chamber of Claim 44, wherein said light source emits radiation containing at least one of UV, optical and IR.

61. A sterilization chamber comprising:

an inlet aperture for air to flow into the chamber, an outlet aperture for air to flow out of the chamber;

a continuous light source disposed inside said chamber and configured to emit light within said chamber;

a moveable inlet device with at least one surface that is highly reflective and configured to increase the fraction of chamber interior surface area that is reflective within said sterilization chamber when said light is emitted; and

a moveable outlet device with at least one surface that is highly reflective and configured to increase the fraction of chamber interior surface area that is reflective within said sterilization chamber when said light is emitted.

62. The sterilization chamber of Claim 61, wherein at least one of said moveable inlet and outlet devices comprises rotating drum having a plurality of retractable vanes extending from a peripheral surface of said rotating drum.

63. The sterilization chamber of Claim 62, wherein said rotating drum mechanism comprises:

a rotating drum mounted on an axle inside a housing coupled to one of said apertures; and

a retractable vane having a reflective surface coupled to an outer surface of said rotating drum and configured to extend from said outer surface of said drum when no external pressure is applied to said retractable vane.

64. The sterilization chamber of Claim 62, wherein the drum is rotated by the air flow.

65. The sterilization chamber of Claim 61, wherein the air flow is at least partially provided by a fan or other pneumatic source.

66. The sterilization chamber of Claim 62, wherein the drum is rotated by an external force such as a motor.

67. The sterilization chamber of Claim 62, wherein an external energy source is used to provide rotational energy to the drum via a motor if the air flow is not sufficient to maintain a minimum rotation rate.

68. The sterilization chamber of Claim 61, wherein all surfaces continuous with the inside of said chamber comprise a reflective surface with reflectivity greater than 75%.

69. A method of moving air through a sterilization apparatus that comprises a sterilization chamber and a rotating drum mounted on an axle within the sterilization chamber, said rotating drum having highly reflective inner and outer surfaces attached to said rotating drum, the method comprising:

coupling said sterilization chamber to said rotating drum; and

rotating said rotating drum so that a plurality of vanes are each respectively extended during a first portion of the said rotation of said drum and said plurality of vanes are each respectively retracted during a second portion of the rotation of said drum.

70. The method of Claim 69, wherein said plurality of vanes are spring loaded.

71. The method of Claim 69, wherein said plurality of vanes are extended and retracted from a surface of the rotating drum due to force applied by a stationary, non-circular, cam mechanism.

72. The method of Claim 69, wherein each of the vanes comprises a pin disposed in an eccentric groove in the interior of the rotating drum and the vanes are extended and retracted from a surface of the rotating drum due to movement of the pins in the eccentric groove.

73. The method of Claim 69, wherein all surfaces that are exposed to the light in said sterilization chamber comprise reflective material with a reflectivity of at least 75%.

74. The method of Claim 69, wherein when a particular vane is extended, said particular vane moves air in to the sterilization chamber.

75. The method of Claim 69, further comprising:

emitting light from a continuously emitting or pulsed light source disposed within said sterilization chamber, wherein said light is reflected from vanes comprising reflective material in and extended position such that substantially no light exits the sterilization chamber via the rotating drum.

76. A modular flux multiplying air sterilization chamber configured to interconnect with at least one other modular chamber, comprising:

a plurality of walls having inner surfaces, wherein each of said inner surfaces comprises a reflective material having a diffuse reflectivity of greater than about 75%;

a first wall of said plurality of walls having an aperture configured to allow air to enter the modular chamber;

a second wall of said plurality of walls having an aperture configured to allow air to exit the modular chamber;

a light source configured to emit a light incident onto at least one of said plurality of inner surfaces.

77. The modular chamber of Claim 76, wherein said light source is configured to emit at least some ultraviolet light.

78. The modular chamber of Claim 76, wherein said plurality of walls is removably connected to certain of said plurality of walls.

79. The modular chamber of Claim 76, wherein said reflective material comprises specially prepared PTFE, or a mixture of a binder and reflecting additives such as barium sulfate, magnesium fluoride, magnesium oxide or aluminum oxide, holmium oxide, calcium oxide, lanthanum oxide, germanium oxide, tellurium oxide, europium oxide, erbium oxide, neodymium oxide, samarium oxide or ytterbium oxide.

80. The modular chamber of Claim 76, wherein said second wall of said modular chamber is operably coupled to a third wall of a second modular chamber so that substantially all of said air exiting said opening through said second wall enters an opening in said third wall.

81. The modular chamber of Claim 76, wherein said first wall of said modular chamber is operably coupled to a fourth wall of a third modular chamber so that substantially all of said air entering said opening through said first wall exits an opening in said fourth wall.

82. The modular chamber of Claim 76, wherein a second modular chamber is operatively coupled to said modular chamber in parallel, such that air flow is divided between the modular chamber.